

What is Claimed Is:

1. A system for subjective evaluation of a vehicle design within a virtual environment using virtual reality comprising:

5 a scaleable physical property representative of the vehicle design, wherein the physical property is adjusted according to a scale ratio for an evaluator of the vehicle design;

10 a computer system for digitally creating a virtual environment having a virtual human immersed within, wherein the virtual environment includes the vehicle design and the virtual human virtually represents a scaled evaluator;

15 a motion capture system for sensing a motion of the evaluator and communicating the sensed motion of the evaluator to the computer system, so that the motion of the evaluator controls the motion of the virtual human in the virtual environment; and

20 a virtual reality display mechanism operatively communicating with the computer system, for providing the evaluator a view of the virtual environment while evaluating the vehicle design.

000000" 81600000

SA

2. The system of claim 1 wherein the motion capture system includes an instrumented glove worn by the evaluator for sensing motion of the evaluator's hand.

5

3. The system of claim 1 wherein the motion capture system includes magnetic spatial tracking sensors located on the evaluator for sensing motion of the evaluator's full body.

10

4. The system of claim 1 wherein the virtual reality display mechanism includes a head mounted display mechanism worn by the evaluator for seeing the virtual environment through an eye of the virtual human.

15

5. The system of claim 1 wherein the computer system includes at least one video terminal displaying a view of the virtual environment as seen through an eye of the virtual human.

20

6. The system of claim 1 wherein the computer system includes at least one video terminal

002080" 8T60E960

SA

displaying a third person view of the virtual human immersed within the virtual environment.

7. A method as set forth in claim 1,
5 wherein the scale ratio is a ratio between a predetermined dimension of the evaluator and a predetermined dimension of a member of a target population.

10 8. A method of subjective evaluation of a vehicle design within a virtual environment using virtual reality, said method comprising the steps of:
preparing an evaluator of a vehicle design for immersion as a virtual human in the virtual
15 environment, wherein the virtual environment is created within a computer system and includes the vehicle design;

determining a scale ratio for the evaluator, wherein the scale ratio is a ratio between
20 a predetermined dimension of the evaluator and a predetermined dimension of a member of a target population;

preparing an adjustable property using the vehicle design and the scale ratio;

002080" 8T60E960

SA 1

growing the virtual human within the
virtual environment to virtually represent a scaled
evaluator;

aligning the virtual human in the virtual
5 environment with the evaluator and the property,

performing the evaluation of the vehicle
design by the evaluator; and

using the evaluation of the vehicle design
in the design of the vehicle.

10

9. A method as set forth in claim 8
wherein said step of preparing an evaluator includes
the step of measuring an anthropometric dimension of
the evaluator.

15

10. A method as set forth in claim 8
wherein said step of preparing an evaluator includes
the step of positioning a motion capture system on
the evaluator for sensing a motion of the evaluator
20 and communicating the sensed motion of the evaluator
to the computer system, so that the motion of the
evaluator controls the motion of the virtual human in
the virtual environment.

002080" 8T60E960

11. A method as set forth in claim 8 wherein said step of preparing an evaluator includes providing the evaluator with a virtual reality display mechanism operatively communicating with the computer system, for providing the evaluator a view of the virtual environment while evaluating the vehicle design.

12. A method as set forth in claim 8 wherein the step of preparing an adjustable property includes the step of determining a scale ratio range for a member of a target population represented in the evaluation and using the scale ratio range to determine adjustability of the property.

15

13. A method as set forth in claim 8 including the step of determining whether to perform a new evaluation and performing a new evaluation if determined to perform a new evaluation.

20

14. A method as set forth in claim 8 wherein said step of growing the virtual human includes the steps of:

002080" 87609360

assuming an initial posture by the evaluator;

digitally establishing locations of motion capture sensors positioned on the evaluator in the
5 initial posture using a computer system;

creating a virtual human digitally to represent the evaluator using the digital motion capture sensor locations for the virtual human, the evaluator's measurements and the scale ratio;

10 aligning the virtual human with the evaluator, wherein the motion capture sensor locations on the virtual human are aligned with the motion capture sensor locations on the evaluator; and

checking that the motion of the virtual
15 human mirrors the motion of the evaluator.

15. A method of subjective evaluation of a vehicle design within a virtual environment using virtual reality, said method comprising the steps of:

20 preparing an adjustable property to represent the vehicle design;

measuring the evaluator;

positioning a full-body motion capture system on an evaluator for sensing a motion of the

002080" 8708E960

sl
A

evaluator and communicating the sensed motion of the evaluator to a computer system, so that the motion of the evaluator controls the motion of the virtual human in the virtual environment;

5 providing the evaluator with a virtual reality display mechanism operatively communicating with the computer system, for providing the evaluator a view of the virtual environment while evaluating the vehicle design

10 determining a scale ratio for the evaluator wherein the scale ratio is a ratio between a predetermined dimension of the evaluator and a predetermined dimension of a member of a target population;

15 adjusting the property using the scale ratio for the evaluator;

growing the virtual human in the virtual environment using the measurements of the evaluator and the scale ratio to virtually represent a scaled
20 evaluator;

aligning the virtual human in the virtual environment to the evaluator and the property;

performing the evaluation of the vehicle design by the evaluator; and

002080" 8160E960

using the evaluation of the vehicle design
in the design of the vehicle.

16. A method as set forth in claim 15,
5 including the step of determining whether to perform
a new evaluation and performing a new evaluation if
determined to perform a new evaluation.

17. A method as set forth in claim 16
10 including the step of determining whether to use a
new evaluator and using a new evaluator if determined
to use a new evaluator.

18. A method as set forth in claim 17
15 including the step of determining whether to revise
the scale ratio if determined not to use a new
evaluator and revising the scale ratio if determined
to revise the scale ratio.

20 19. A method as set forth in claim 15
wherein said step of growing the virtual human
includes the steps of:

assuming an initial posture by the
evaluator;

002080" 87602960

SAI

digitally establishing locations of motion capture sensors positioned on the evaluator in the initial posture using a computer system;

creating a virtual human digitally using
5 the motion capture sensor locations for the virtual human and the scaled measurements of the evaluator;

aligning the virtual human with the evaluator, wherein the motion capture sensor locations on the virtual human are aligned with the
10 motion capture sensor locations on the evaluator; and

checking that the motion of the virtual human mirrors the motion of the evaluator.

20. A method as set forth in claim 15,
15 including the step of determining a scale ratio range for a member of a target population represented in the evaluation and using the scale ratio range to determine adjustability of the property.

002030" 8160E360

SA